

CLAIMS:

1. An apparatus for applying discrete components onto a moving substrate, said
5 apparatus including:
a first rotatable drive member;
at least a second rotatable drive member which is substantially coaxial with said first drive
member;
a first servo motor connected to rotate said first drive member;
10 at least a second servo motor connected to rotate said second drive member;
a first transfer puck driven by said first rotatable drive member;
at least a second transfer puck driven by said second rotatable drive member;
a first electronic drive connected to said first servo motor, said first electronic drive
configured to selectively move said first transfer puck at a first, pickup speed and
15 at least a second, deposit speed;
at least a second electronic drive connected to said second servo motor, said second
electronic drive configured to selectively move said second transfer puck at said
first pickup speed and at said second deposit speed.
- 20 2. An apparatus as recited in claim 1, further including a transport mechanism for
moving said substrate at said deposit speed.
3. An apparatus as recited in claim 1, wherein said first transfer puck is configured to
carry a first discrete component for placement onto said moving substrate; and said
25 second transfer puck is configured to carry at least a second discrete component for
placement onto said moving substrate.
4. An apparatus as recited in claim 1, wherein said first rotatable drive member and at
least said second rotatable drive member are substantially concentric.
- 30 5. An apparatus as recited in claim 1, wherein said first transfer puck is operatively
connected to said first rotatable drive member with a first, radially extending arm member;
and said second transfer puck is operatively connected to said second rotatable drive
member with a second, radially extending arm member.

6. An apparatus as recited in claim 1, wherein
said first servo motor is configured to operatively move said first transfer puck along a
predetermined rotational path; and

5 said second servo motor is configured to operatively move, in sequence, said second
transfer puck along said predetermined rotational path substantially without
contacting said second transfer puck against said first transfer puck.

7. An apparatus as recited in claim 1, further including a synchronizer which can
10 maintain a selected sequence of relative separation distances between said first transfer
puck and said second transfer puck during their movements along said predetermined
rotational path.

8. An apparatus as recited in claim 1, wherein said first servo motor and said first
15 electronic drive are configured to move said first transfer puck to provide a deposit speed
of at least about 6 m/sec .

9. An apparatus as recited in claim 1, wherein said first servo motor can provide a
torque of at least about 50 Newton-meter.

10. An apparatus as recited in claim 1, wherein said second servo motor can provide a
torque of at least about 50 Newton-meter.

11. An apparatus as recited in claim 1, wherein said first servo motor and said first
25 electronic drive can cooperatively provide said first, pickup speed for a pickup dwell
interval which substantially corresponds to one product repeat.

12. An apparatus as recited in claim 1, wherein said second servo motor and said second
30 electronic drive can cooperatively provide said first, pickup speed for a pickup dwell
interval which substantially corresponds to one product repeat.

13. An apparatus as recited in claim 1, wherein said second, deposit speed differs from
said first, pickup speed to provide a deposit/pick-up speed ratio of at least about 1.5:1.

14. An apparatus as recited in claim 1, wherein said first servo motor and said first electronic drive can cooperatively provide an angular acceleration of at least about 600 radian/sec² to said first transfer puck.

5 15. An apparatus as recited in claim 1, further including a retaining mechanism configured to releasably hold a discrete component on said first transfer puck.

16. An apparatus as recited in claim 15, wherein said retaining mechanism includes a vacuum device.

10 17. An apparatus as recited in claim 1, further including:
a third rotatable drive member which is substantially coaxial with said first drive member;
a third servo motor connected to rotate said third drive member;
a third transfer puck driven by said first rotatable drive member; and
15 a third electronic drive connected to said third servo motor, said third electronic drive configured to selectively move said third transfer puck at said first pickup speed and at said second deposit speed.

20 18. An apparatus for changing a speed of discrete components, said apparatus including:
a first rotatable drive member;
at least a second rotatable drive member which is substantially coaxial with said first drive member;
a first servo motor connected to rotate said first drive member;
at least a second servo motor connected to rotate said second drive member;
25 a first transfer puck driven by said first rotatable drive member;
at least a second transfer puck driven by said second rotatable drive member;
a first electronic drive connected to said first servo motor, said first electronic drive configured to selectively move said first transfer puck at a first, pickup speed and at least a second, deposit speed;
30 at least a second electronic drive connected to said second servo motor, said second electronic drive configured to selectively move said second transfer puck at said first pickup speed and at said second deposit speed.

19. A method for applying discrete components onto a moving substrate, said method including:

a providing of a first rotatable drive member;

a providing of at least a second rotatable drive member which is substantially coaxial with

5 said first drive member;

a connecting of a first servo motor to rotate said first drive member;

a connecting of at least a second servo motor to rotate said second drive member;

a driving of a first transfer puck with said first rotatable drive member;

a driving of at least a second transfer puck with said second rotatable drive member;

10 a connecting of a first electronic drive to said first servo motor, said first electronic drive
 configured to selectively move said first transfer puck at a first pickup speed and at
 least a second deposit speed;

15 a connecting of at least a second electronic drive to said second servo motor, said second
 electronic drive configured to selectively move said second transfer puck at said
 first pickup speed and at said second deposit speed.

20. A method for applying discrete components onto a moving substrate, said method including:

a rotating of a first rotatable drive member with a first servo motor;

20 a providing of at least a second rotatable drive member which is substantially coaxial with
 said first drive member;

a rotating of said second rotatable drive member with a second servo motor;

a moving of a first transfer puck with said first rotatable drive member, said first transfer
 puck configured to place a first discrete component onto said moving substrate;

25 a moving of at least a second transfer puck with said second rotatable drive member, said
 second transfer puck configured to place a second discrete component onto said
 moving substrate;

30 a connecting of a first electronic drive to said first servo motor, said first electronic drive
 configured to selectively move said first transfer puck at a first pickup speed and at
 least a second deposit speed;

a connecting of at least a second electronic drive to said second servo motor, said second
 electronic drive configured to selectively move said second transfer puck at said
 first pickup speed and at said second deposit speed.

21. A method for changing a speed of discrete components, said method including:
 a rotating of a first rotatable drive member with a first servo motor;
 a providing of at least a second rotatable drive member which is substantially coaxial with
 said first drive member;
 5 a rotating of said second rotatable drive member with a second servo motor;
 a moving of a first transfer puck with said first rotatable drive member, said first transfer
 puck configured to place a first discrete component onto said moving substrate;
 a moving of at least a second transfer puck with said second rotatable drive member, said
 second transfer puck configured to place a second discrete component onto said
 10 moving substrate;
 a connecting of a first electronic drive to said first servo motor, said first electronic drive
 configured to selectively move said first transfer puck at a first pickup speed and at
 least a second deposit speed;
 a connecting of at least a second electronic drive to said second servo motor, said second
 15 electronic drive configured to selectively move said second transfer puck at said
 first pickup speed and at said second deposit speed.

22. A method as recited in claim 19, further including a configuring of said first servo
 motor to provide a torque of at least about 100 Newton-meter.

23. A method as recited in claim 19, further including a configuring of said first servo
 motor and said first electronic drive to provide a deposit/pick-up speed ratio which is at
 least about 1.5:1.

24. A method as recited in claim 19, further including a configuring of said first servo
 motor and said first electronic drive to cooperatively provide an angular acceleration of at
 least about 600 radian/sec² to said first transfer puck .

25. A method as recited in claim 19, further including
 30 an operatively moving of said first transfer puck along a predetermined rotational path;
 and
 an operatively moving of said second transfer puck, in sequence, along said
 predetermined rotational path substantially without contacting said second transfer
 puck against said first transfer puck.

26. A method as recited in claim 19, further including
a providing of a third rotatable drive member which is substantially coaxial with said first
drive member;
5 a connecting of a third servo motor to rotate said third drive member;
a driving of a third transfer puck with said third rotatable drive member;
a connecting of a third electronic drive to said third servo motor, said third electronic drive
configured to selectively move said third transfer puck at said first pickup speed
and at least said second deposit speed.

27. A method as recited in claim 26, further including
an operatively moving of said first transfer puck along a predetermined rotational path;
an operatively moving of said second transfer puck, in sequence, along said
predetermined rotational path substantially without contacting said second transfer
15 puck against said first transfer puck; and
an operatively moving of said third transfer puck, in sequence, along said predetermined
rotational path substantially without contacting said third transfer puck against said
first or second transfer pucks.

28. A method as recited in claim 21, further including
a configuring of said moving of said first transfer puck to provide an orbital path length of
said first transfer puck; and
a configuring of said moving of said first transfer puck to correspond to a speed profile
which provides a single-cycle motion-area value that substantially equals said
25 orbital path length of said first transfer puck.